Analysis of Student Outcomes at the University of Manitoba

by
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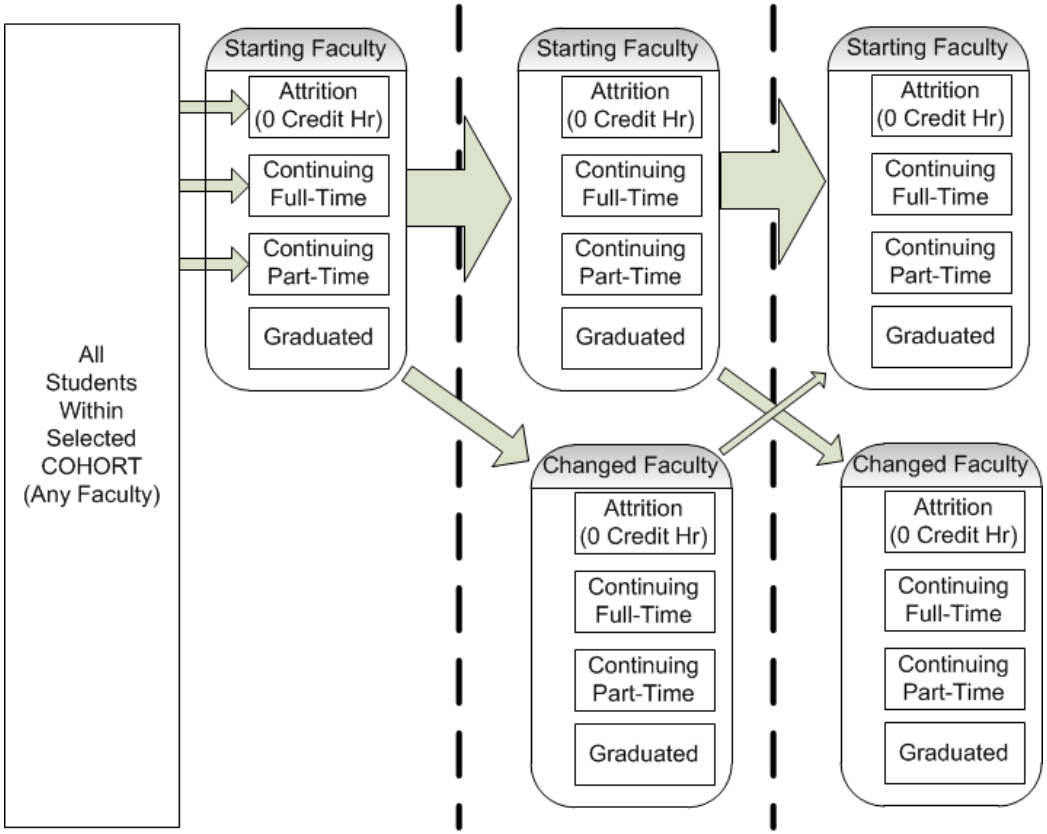
What are Student Outcomes?

- To understand the length of time it takes for students to graduate
- The percentage of students who graduate
- The percentage of students who do not graduate
  - When they discontinue
- The percentage of students who continue

What Does a University Look Like?



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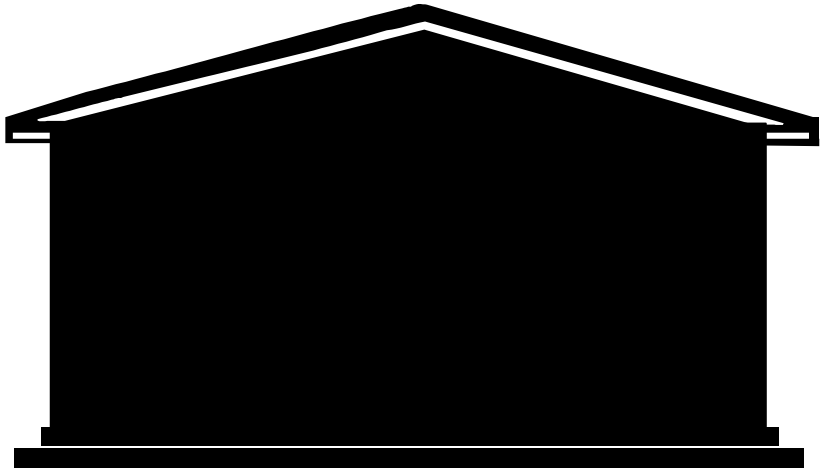
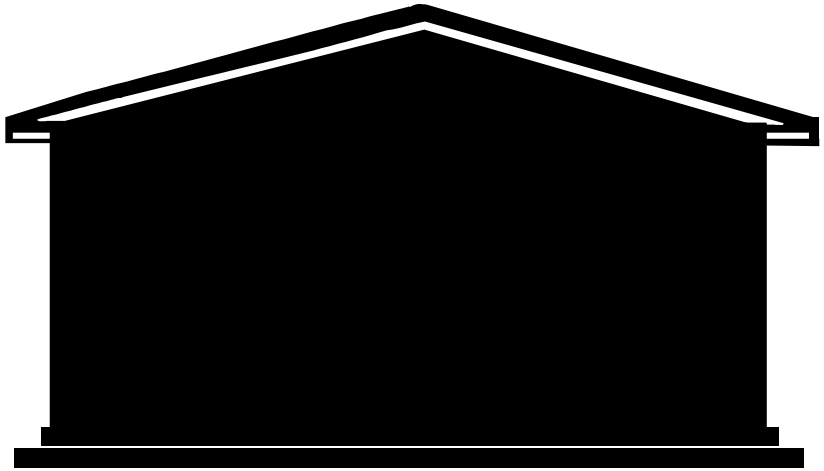


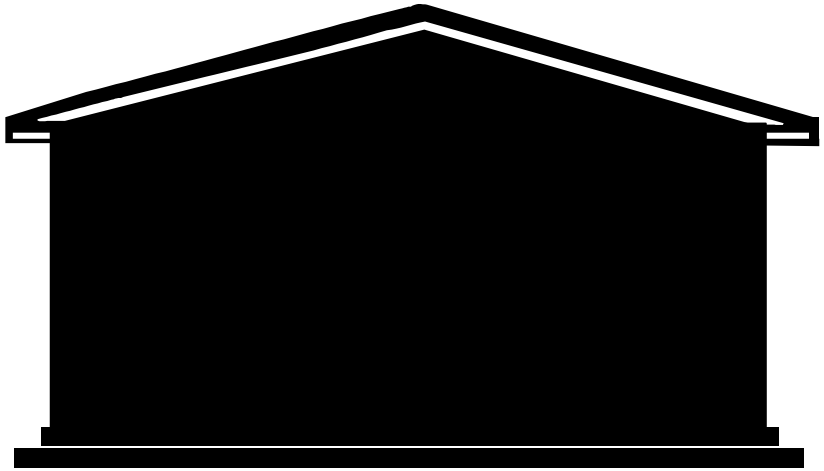
- I see the University as a black box

What Does a University Look Like?



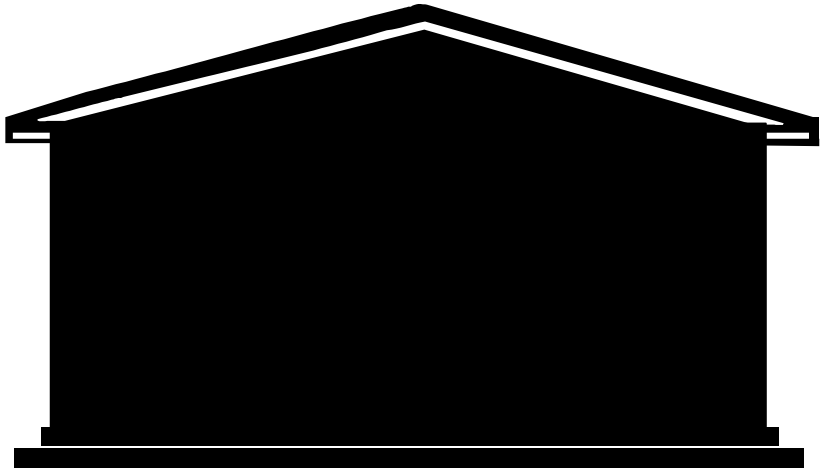
- Students come in at different
  - Times
  - Programs

What Does a University Look Like?



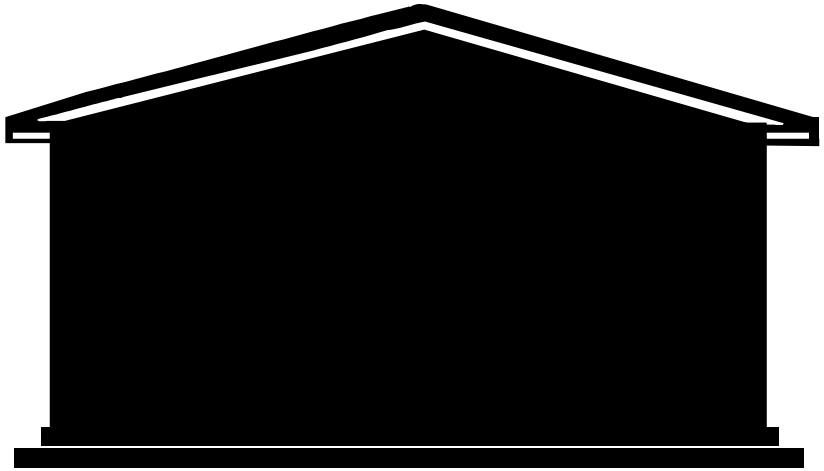
- Students leave the University
  - Just wasn't for them
  - They Missed Family/Friends

What Does a University Look Like?



- Students leave the University
  - Decided to go a different route
  - Decided after a year or so to return

What Does a University Look Like?



- Preferred Choice of Exit
  - Graduation

Design Decisions/Criteria

- Duration of Analysis
  - 1 to 10 years
  - Entry status
- Definition of Full-Time
  - Ability to select %
  - Duration of time
- Categorization at end of year
  - Continuing
    - Full-time
    - Part-time
  - Discontinued
    - Did not return
    - Completed 0 credit hours
- Categorization at end of year (cont'd)
  - Graduated
    - Graduated & did not continue
    - Graduated & continued
  - Discontinued
    - Did not return
    - Completed 0 credit hours
- Ability to categorize/group a student
  - Starting new program
    - Direct Entry Student
    - Inter University Transfer
    - …
  - International

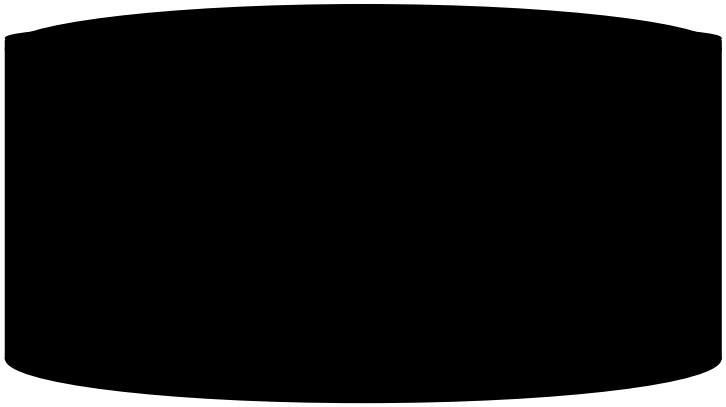
How I wanted the program to work

- Once again I want to look at this program as a black box

How I wanted the program to work

- COHORT = list of students + attributes
- Year to Start Analysis
- Year to End Analysis

How I wanted the program to work



- Data to process

How I wanted the program to work

- Output
  - Status of every student after every year for up to 10 Years

Common Abbreviations Used

- Year → yr
- Dataset → ds
- Student → stud
- Analysis →anal

Outcome Analysis Program

- Select Yearly Data Required

  CreateDataset(StartYear, EndYear, Cohort_file, OutputDataset)

- Perform Analysis

  AnalysisByFaculty(OutputDataset, ResultsDataset, 0.6);

- Create Reports

YEARLY COHORT COMPARISON OF STUDENT OUTCOMES[1]

D) All Cohorts Combined (A + B + C)

Students Entering as Full-Time[2]

Attrition[3]:

Year	Cohort Size	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
1999-00	4601	17%	22%	24%	25%	26%	26%	26%
2000-01	5192	17%	22%	25%	26%	26%	26%	26%
2001-02	5425	16%	23%	26%	27%	27%	28%	28%
2002-03	5499	15%	22%	26%	27%	28%	28%	28%
2003-04	5868	15%	23%	NA[4]	27%	27%	28%	27%
2004-05	5905	17%	NA[4]	27%	28%	29%	29%	–
2005-06	5948	NA[4]	23%	27%	28%	28%	–	–
2006-07[5]	–	–	–	–	–	–	–	–
2007-08	5613	17%	24%	27%	–	–	–	–
2008-09	5907	15%	23%	–	–	–	–	–
2009-10	6146	17%	–	–	–	–	–	–

Continuing[3]:

Year	Cohort Size	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
1999-00	4601	77%	57%	32%	15%	7%	4%	3%
2000-01	5192	76%	55%	31%	15%	7%	4%	3%
2001-02	5425	77%	55%	31%	15%	8%	4%	3%
2002-03	5499	77%	56%	33%	17%	9%	5%	3%
2003-04	5868	77%	55%	NA[4]	16%	9%	4%	3%
2004-05	5905	75%	NA[4]	34%	18%	9%	5%	–
2005-06	5948	NA[4]	56%	35%	19%	10%	–	–
2006-07[5]	–	–	–	–	–	–	–	–
2007-08	5613	76%	58%	37%	–	–	–	–
2008-09	5907	78%	58%	–	–	–	–	–
2009-10	6146	76%	–	–	–	–	–	–

Graduated at the end of [3]:

Year	Cohort Size	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
1999-00	4601	6%	20%	43%	60%	67%	70%	71%
2000-01	5192	8%	23%	45%	60%	67%	70%	71%
2001-02	5425	7%	22%	43%	58%	64%	68%	70%
2002-03	5499	8%	22%	42%	56%	64%	67%	69%
2003-04	5868	8%	22%	NA[4]	57%	64%	68%	70%
2004-05	5905	8%	NA[4]	39%	54%	62%	66%	–
2005-06	5948	NA[4]	20%	39%	53%	62%	–	–
2006-07[5]	–	–	–	–	–	–	–	–
2007-08	5613	7%	17%	35%	–	–	–	–
2008-09	5907	7%	19%	–	–	–	–	–
2009-10	6146	7%	–	–	–	–	–	–

Notes:

1. Percentages for Attrition + Continuing + Graduated may not add to 100% due to rounding.
2. Full-time is based on 60% of normal load at November 1 of Year 1. Registration in subsequent years may be at full or part-time status.

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Outcome Analysis Program

- Select Yearly Data Required

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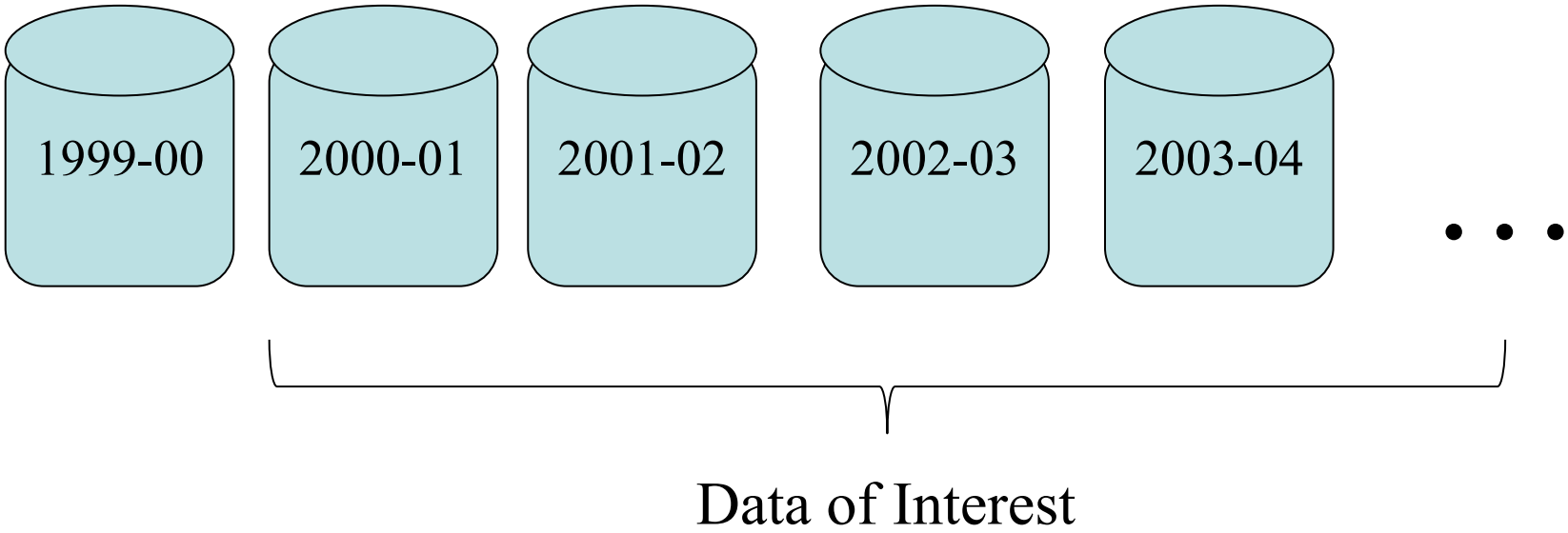
Select Required Yearly Data

- Read in Data from Start Year to End Year



Select Required Yearly Data

- Read in Data from Start Year to End Year
  - Varying Start & End Year
- Flexibility to change input datasets
- Decided to use a table of tables

VIEWTABLE: Db_sts.Tbl_analblock

	Year	Analysis	dataset
1	1998_99	0	Ds1998_1999
2	1999_00	0	Ds1999_2000
3	2000_01	0	Ds2000_2001
4	2001_02	0	Ds2001_2002
5	2002_03	0	Ds2002_2003
6	2003_04	0	Ds2003_2004
7	2004_05	0	Ds2004_2005
8	2005_06	0	Ds2005_2006
9	2006_07	0	Ds2006_2007
10	2007_08	0	Ds2007_2008
11	2008_09	0	Ds2008_2009
12	2009_10	0	Ds2009_2010
13	2010_11	0	Ds2010_2011
14	2011_12	0	Ds2011_2012
15	2012_13	0	Ds2012_2013

Select Required Yearly Data

- Rename dataset columns to represent year of analysis

  2000-01 → Year1_<col>

  2001-02 → Year2_<col>

  …..

Fall_faculty	Fall_crhr	Fall_vwhr	Fall_crscnt	Fall_fullpart	Fall_NormLoad	Fall_yc
16	0	0	0.5	2	15	MN
16	0	0	0.5	1	15	MSC
01	3	0	1	2	15	2

Select Yearly Data Required

- Combine all the years of data into OutputDataset

SAS Macro Programming

- Purchased Book

  Carpenter's Complete Guide to the SAS Macro Language

  by Art Carpenter

- The macro language provides tools that
  - Pass information between SAS steps
  - Dynamically create code at execution time
  - Conditionally execute DATA or PROC steps
  - Create generalized and flexible code

Select Required Yearly Data

- Create Function “CreateDataset”

```
CreateDataset(StartYr, EndYr,
ds_cohort, ds_output);
```

BASICS – SAS Macro Function

- Create Simple Function

```
%macro FunctionName();

<CODE>

%mend FunctionName;
```

BASICS – SAS Macro Function

- Create Function & Passing variables

```
%macro FunctionName(var1, var2, ….);

<CODE>

%mend FunctionName;
```

Select Required Yearly Data

- Create Function “CreateDataset”

```
%macro CreateDataset(StartYr, EndYr,
                     ds_cohort, ds_output);

        <CODE>

%mend CreateDataset;
```

BASICS- SAS Macro Variable

- Assigning a Macro Variable

```
%let variable1 = 25;
%let variable2 = “25”;
%let variable3 = number;
```

BASICS - SAS Macro Variable

- Assigning Macro Variables From a Function

```
CreateDataset(StartYr, EndYr,
                    ds_cohort, ds_output);

CreateDataset("2000-01", "2009-10", Cohort00,ds00);

        %let StartYr = "2000-01"
        %let EndYr = "2009-10"
        %let ds_cohort = Cohort00
        %let ds_output = ds00
```

BASICS - SAS Macro Variable

- Using a Macro Variable
  - Must identify a macro variable using a “&”
    (Optionally end it with a “.”)
  - All macros are processed before the program is run
  - Content of the macro variable is substituted

```
%let StartYr = “2000-01”

if Year = &StartYr then do;
```

Is changed to

```
if Year = “2000-01” then do;
```

%macro CreateDataset(….);

- Mark datasets to be used

```
Data AnalBlock;
        set db_ocad.tbl_analblock;
         if year >= &StartYr and year <= &EndYr
                then Analysis = 1;
run;
```

VIEWTABLE: Db_sts.Tbl_analblock

	Year	Analysis	dataset
1	1998_99	0	Ds1998_1999
2	1999_00	0	Ds1999_2000
3	2000_01	0	Ds2000_2001
4	2001_02	0	Ds2001_2002
5	2002_03	0	Ds2002_2003
6	2003_04	0	Ds2003_2004
7	2004_05	0	Ds2004_2005
8	2005_06	0	Ds2005_2006
9	2006_07	0	Ds2006_2007
10	2007_08	0	Ds2007_2008

%macro CreateDataset(….);

- Create local copy of cohort file

```
Data Cohort;
        set &ds_cohort;
        include = 1;
run;
```

%macro CreateDataset(….);

- Read dataset names & count total years

```
data _null_;
        set AnalBlock;
        if Analysis = 1 then do;
                i+1;
                ii = left(put(i,2.));
                datas = compress(dataset);
                call symput('ds'||ii, datas);
                call symput('total',ii);
        end;
run;
```

BASICS – SAS Macro functions

- **Symput**
  - Assigns a value produced in a DATA step to a macro variable.
  - CALL SYMPUT(macro-variable, value);

%macro CreateDataset(….);

- Read dataset names & count total years

```
data _null_;
        set AnalBlock;
        if Analysis = 1 then do;
                i+1;
                ii = left(put(i,2.));
                datas = compress(dataset);
                call symput('ds'||ii, datas);
                call symput('total',ii);
        end;
run;
```

VIEWTABLE: Db_sts.Tbl_analblock

	Year	Analysis	dataset
1	1998_99	0	Ds1998_1999
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3	2000_01	0	Ds2000_2001
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5	2002_03	0	Ds2002_2003
6	2003_04	0	Ds2003_2004
7	2004_05	0	Ds2004_2005
8	2005_06	0	Ds2005_2006
9	2006_07	0	Ds2006_2007
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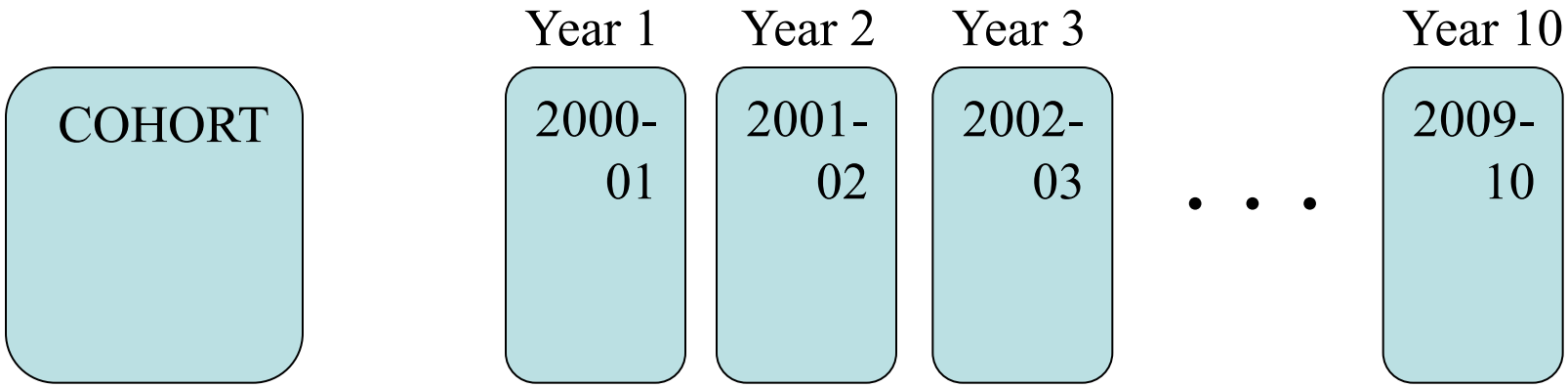
%macro CreateDataset(….);

- Main loop of combining data records



%macro CreateDataset(….);

- Main loop of combining data records

```
%do j=1 %to &total;
    proc sql;
            create table yr&j as
            select student_number,
                    sumr_faculty as y&j._sumr_faculty,
                    sumr_crhr as y&j._sumr_crhr,
                    sumr_vwhr as y&j._sumr_vwhr,   etc
            from db_ocad.&&ds&j
            where student_number in(select student_number from cohort);
    proc sort data=yr&j; by student_number; run;

    data new_ds;
            merge new_ds yr&j;
                    by student_number;
    run;
%end;
```

BASICS – SAS Macro loop

- **Do Loop**

```
%do j=1 %to &total;

%end;
```

  - This loop will start at j=1
  - Continues to loop incrementing j by 1
  - Stops when j = total

%macro CreateDataset(….);

- Create local copy of cohort file

```
proc sql;
        create table yr&j as
        select student_number,
                sumr_faculty as y&j._sumr_faculty,
                sumr_crhr as y&j._sumr_crhr,
                sumr_vwhr as y&j._sumr_vwhr,   etc
        from db_ocad.&&ds&j
        where student_number in(select
                                student_number from cohort);
```

Favorite Line of Code

- db_ocad.&&ds&j
  - J = 1 to total → if J is 1 then

    &&ds&j → &&ds1
  - ds1 was a variable created with symput

    ds = compress(dataset);

    call symput('ds'||ii, ds);
  - The processor then resolves the &ds1 with its content

Favorite Line of Code

- **db_ocad.&&ds&j (Cont'd)**
  - **The processor then resolves the &ds1 with its content**

    db_ocad.ds2000_01

%macro CreateDataset(….);

- Main loop of combining data records

```
proc sort data=yr&j; by student_number; run;

data new_ds;
        merge new_ds yr&j;
                by student_number;
run;
```

Select Yearly Data Required

- Using Base SAS & the Macro Language
  - Created a function that can have
    - Varying Start Year
    - Varying Duration
    - Variety of input datasets

    - And generate a dataset of variable width

Conclusions

- I have already seen many improvements that could be applied
- SAS Macros enhance the power of SAS
- Students are very important to us as a University, which is why we do this type of analysis